PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : D21C 1/02, 1/10

A1

(11) International Publication Number: **WO 98/35089**

(43) International Publication Date: 13 August 1998 (13.08.98)

(21) International Application Number: PCT/SE97/00193

(22) International Filing Date: 7 February 1997 (07.02.97)

(71) Applicant *(for all designated States except US)*: KVAERNER PULPING AB [SE/SE]; P.O. Box 1033, S–651 15 Karlstad (SE).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: GUSTAVSSON, Lennart [SE/SE]; Renvallsvägen 38, S–653 50 Karlstad (SE). SNEKKENES, Vidar [NO/SE]; Herrhagsgatan 62, S–652 19 Karlstad (SE). CARLSSON, Torbjörn [SE/SE]; Botten Ekeberg, S–661 96 Långserud (SE). SVANEGÅRD, Bo [SE/SE]; Jan Ersas väg 3, S–656 38 Karlstad (SE).

(74) Agent: KYLIN, Peter; Kvaerner Pulping AB, P.O. Box 1033, S–651 15 Karlstad (SE).

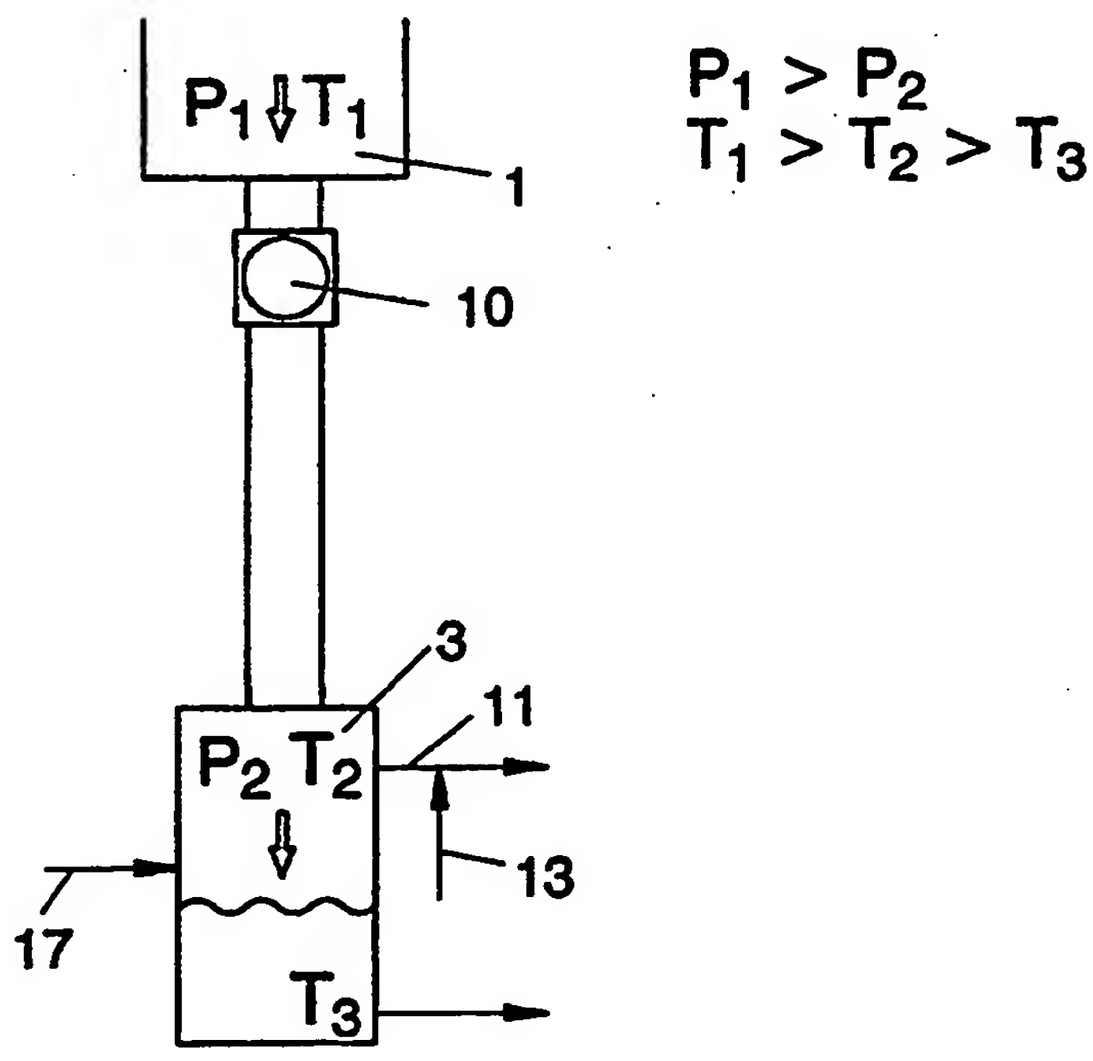
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.
With amended claims.
In English translation (filed in Swedish).

(54) Title: METHOD AND APPARATUS FOR PREHEATING AN IMPREGNATING CELLULOSIC MATERIAL

(57) Abstract

Method and apparatus for treatment of comminuted fibre material before chemical digestion of the material, whereby the material (a) in a first step is heated, preferably by addition of steam, in a gas atmosphere with a pressure (P1) and a temperature (T1), (b) in a second step has air extracted from it, in a gas atmosphere with a pressure (P2) and a temperature (T2), where (T1) > (T2) and (P2) is sufficiently lower than (P1) in order to extract air from the material, (c) in a third step is soaked in impregnation liquid, whereby said first step (a) is performed in a first space (1, 2, 1a) and said second step (b) is performed in a second space (3, 1b). The material is added to this second space in such a way that it is exposed to a lowering in the pressure, when it is transferred from the first space to the second space. Said impregnation liquid with a temperature (T3) is added to said material in sequentially direct connection to a retention time in the gas atmosphere (P2, T2) in said second space.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

METHOD AND APPARATUS FOR PREHEATING AND IMPREGNATING CELLULOSIC MATERIAL

TECHNICAL FIELD

The present invention relates to a method and an apparatus for heating and impregnating treatment of a comminuted fibre material, before chemical digestion of the material to paper pulp.

STATE OF THE ART AND PROBLEM

The need to preheat and degas the comminuted fibre material (the chips) before it is soaked in impregnation liquid in a first step and then cooking liquid for the chemical digestion, has long been realised in the pulp producing industries. A so called steaming process is used in today's modern pulp mills, in which process the chips are firstly exposed to steam treatment in an atmospheric chip bin, whereafter the chips, via a so called low pressure feeder, are conveyed to a steaming vessel for additional steam treatment. Normally, there is an overpressure in the steaming vessel and the chips fall, at the end of the vessel, by gravity, down into a chip chute which is connected to a high pressure feeder, which high pressure feeder passes chips and liquid, through a lock, to the high pressure system which is prevailing in a preimpregnation vessel or a digester. Prechosen levels of chips and liquid are sustained in the chip chute, which assures a steady and air free feeding to the high pressure feeder.

When the chips are soaked in a liquid, there is an impregnation taking place, which in today's system is based on diffusion. It is very important, in order to achieve diffusion, that the air and other gases that originally exists in the cavities in the chips and the fibres has been removed and replaced with a liquid, which normally is

condensate. Hence, this is achieved in today's system by heating the chips with steam in an atmospheric chip bin. During the heating to steam saturation temperature, air is slowly leaving the cavities. The chips will, nevertheless, in reality not reach the saturation temperature at the prevailing pressure, due to:

1. The heat transfer is dependent on the difference in temperature between chips and steam. The heating process is thus asymptotic in time. The heat transfer coefficient in chips and fibre affects the time factor of the heat transfer in a negative way.
2. There is, due to the heating in a chip bin normally being counter current, a pressure drop over the chip bed. This is a result of the packing degree of the chip bed and the removal of air and gases. The temperature of the chip bed will thus never in practice correspond to the steam saturation temperature at the pressure of the chip bed, which leads to air remaining in the chip pieces.

It has been shown, in laboratory experiments, that the steaming process is asymptotic in time. Traditional steaming processes demand a steam treatment of 10-20 minutes to achieve an acceptable result.

A method has been suggested, in a couple of older patents (SE 169 725 and SE 154 056), to steam chip material batchwise, where the chips are steam treated in a pressure vessel at an overpressure. After lowering of the pressure to atmospheric pressure or a slight overpressure, the chips are impregnated with liquid and cooking can take place in the same vessel.

In the patent application EP 161 330, there is described a continuous method of steaming in a system which shows great similarities with the conventional system for continuous pretreatment of chips. In this method the steaming vessel is, however, filled with liquid and the

removal of air is said to take place in a step without addition of heat and which is distinctly separated from a previous (in the chip bin) steam treatment step. Through this method, there is, for instance, achieved that a lower temperature (of 96-102°C) than normally is prevailing in the chip chute, between the steaming vessel and the high pressure feeder, which, in combination with a relatively high pressure, leads to a decreased risk of flashing in the high pressure feeder.

SOLUTION AND ADVANTAGES

Through the invention which is presented here, there is a, preferably continuous, method and a, preferably continuous, apparatus, by which, through basic thermodynamic, the air in the cavities of the chips and the fibres can quickly be replaced with steam. When this steam, thereafter, is brought to condensate, there arises an underpressure in the cavities, whereafter the impregnation liquid is quickly drawn into the chips, which is in contrast to the slow diffusion process of today.

The object of the invention is thus to achieve a method for treatment of comminuted fibre material before chemical digestion of the material, whereby the material,

(a) in a first step is heated, preferably by addition of steam, in a gas atmosphere with a pressure (P1) and a temperature (T1),

(b) in a second step has air extracted from it, in a gas atmosphere with a pressure (P2) and a temperature (T2), where (T1)>(T2) and (P2) is sufficiently lower than (P1) to extract air from the material,

(c) in a third step is soaked in impregnation liquid,

where said first step (a) is performed in a first space and said second step (b) is performed in a second space. The material is added to this second space in such a way that it is exposed to a lowering in the pressure, when it is transferred from the first space to the second space. The

impregnation liquid with a temperature (T3) is added to the material in sequentially direct connection to a retention time in the gas atmosphere (P2, T2) in said second space.

It is preferred that said first and second spaces consists of separate vessels.

The chips are thus, in the method according to the invention, heated in a first step at a pressure P1, which preferably is atmospheric, with for example low pressure steam to a temperature T1 of about 100°C. The heating can, alternatively take place at a pressure P1, which is greater than atmospheric pressure, and is in that case driven to a temperature T1 at about 120-130°C. The heating suitably takes place during a time interval of below 5 minutes, preferably below 4 minutes and even more preferred below 3 minutes, when the method is pressurised. Thereafter there is conducted, regardless of which alternative that has been used for the heating, in connection with a transfer of the material to a second space, a preferably sudden lowering of the pressure to a level somewhat below the steam saturation pressure at the chip temperature. The partial pressure for the air/gas-mixture is thus reduced, preferably fast, and the gas is conducted away. Thereby, arises preferably an underpressure in the second step. The pressure is then 1 bar (abs)>P2>0.3 bar (abs) and the temperature T2 is somewhat lower than in the first step. The moist in the cavities of the chip pieces will, depending upon the degree of lowering of the pressure, flash, whereby air is extracted and replaced with saturated steam. When the chip pieces thereafter are soaked in a colder (T3) impregnation liquid, the steam inside the cavities will condensate, whereby an underpressure is created. Thereby, is it the case that 100°C>T1-T3>10°C, preferably 60°C>T1-T3>20°C. The underpressure gives a pressure difference in relation to the surrounding liquid, which leads to liquid quickly being drawn into the chip pieces. In that way, an impregnation takes place, which, in comparison with today's diffusion process, is very fast. When the chip pieces thereafter are

conveyed into a high pressure system, will steam that might be remaining, in the same way condense and additional liquid will be drawn in.

It is, in the case where the heating has been taking place at an overpressure, preferable that the lowering of the pressure in connection with the transferring of the material to the second space, not is driven to an underpressure, whereby P2 is a slight overpressure or an atmospheric pressure. It is though essential that the pressure P2 is adequately lower than P1 in order to be able to extract air from the fibre material. The pressure difference is suitably within the range 0.01-1.0 bar, preferably 0.02-0.7 bar and even more preferably 0.1-0.5 bar.

Said lowering of the pressure is, when said first and second spaces do not consist of separate vessels, conducted so that P2 only is marginally lower than P1. The lowering of the pressure is hereby not sudden, but is rather based on a pressure drop over the bed of chip pieces.

The invention also comprises an apparatus for treatment of comminuted fibre material before chemical digestion of the material, comprising a vessel with devices for addition of steam, which vessel is operatively connected with a sluice device for feeding the material to a vertical chute with devices for sustaining levels of chips and liquid therein, whereby said sluice device passes the fibre material through a lock, from a higher pressure to a lower pressure.

A more detailed description of the apparatus is to be found in the description of the drawings.

It is an advantage of the invention, that the chip bin, in a preferred embodiment, can be manufactured considerably cheaper, since it can be made smaller and without steam addition. Other advantages in the equipment is that no gas tight feeding screw or fan is needed. The piping and instrumenting will also be less extensive than in a conventional system.

The invention also gives environment related advantages with, for example, lowered discharges of badly smelling compounds.

DESCRIPTION OF THE DRAWINGS

Figure 1 Shows a diagram over the principle of a preferred embodiment of the method according to the invention.

Figure 2 Shows a possible set of apparatus to conduct a method according to the invention.

Figure 3 Shows yet a possible set of apparatus to conduct a method according to the invention, where the first and the second spaces are contained within the same vessel.

Detail 1, shown in figure 1, symbolises the first step according to the invention. The detail 1, consists, in the preferred case, of a chip bin, whereby there is no need for a steaming vessel in the system. The chips are, in this first step, thus heated at a pressure P1, which preferably is atmospheric, with, for example, low pressure steam, to a temperature T1 of about 100°C. The heating takes place during a time interval of about 5-15 minutes. Thereafter there is conducted, in connection with a transfer of the material, via a sluice device 10, to a second vessel 3, a sudden lowering of the pressure to a level P2 somewhat below the steam saturation pressure at the chip temperature. The partial pressure for the air/gas-mixture is thus quickly reduced, and the gas is conducted away with the aid of a vacuum pump (not shown), which via a tubular screen (not shown) is connected to a outlet conduit 11. Thereby, arises an underpressure in the second step. The pressure is thereby preferably 1 bar (abs)>P2>0.3 bar (abs) and the temperature T2 is somewhat lower than in the first

step. The moist in the cavities of the chip pieces will, depending upon the degree of lowering of the pressure, flash, whereby air is extracted and replaced with saturated steam. There is a liquid pool in the bottom of the vessel 3, which pool has a temperature T3, which is lower than the temperature T2 of the chips and the gas phase that is present above the liquor level. When the chip pieces are soaked in this liquid which is relatively seen colder, the steam inside the cavities will condensate, whereby an underpressure is created. This underpressure gives a pressure difference in relation to the surrounding liquid, which leads to liquid quickly being drawn into the chip pieces. When the chip pieces thereafter are conveyed into a high pressure system, will steam that might be remaining, in a similar way condense and additional liquid will be drawn in. In this way, an impregnation takes place, which, in comparison with today's diffusion process, is very fast.

The continuously operating apparatus set shown in figure 2, comprises a vertical chip bin 1, a horizontal steaming vessel 2 and a vertical chip chute 3. Chip are fed into the upper part of the chip bin, which is atmospheric and, in a preferred embodiment without steam addition, which means that it has a function of mainly being a buffer for a steady flow. The chips are measured in, with the aid of a chip meter 4, via a low pressure feeder 5 into the steaming vessel 2. Low pressure steam, preferably from one of the digester flashes 18, is added to the steaming vessel, through a conduit 6, and condensate is withdrawn through a conduit 7 for promotion to the condensate handling system of the mill. The low pressure feeder 5 and the steaming vessel 2 are degassed with aid of the conduits 8 and 9. There are, preferably, an overpressure in the steaming vessel 2 and the chips will, through the steam treatment reach a temperature of about 120°C. The chips leave the vessel, after a retention time of some minutes, in order to be passed through a lock, by a second low pressure feeder 10, down into the chip chute 3. Levels of

chip and liquid are sustained in the chip chute, which assures a steady and air free feeding via a high pressure feeder 12, to the following high pressure system for preimpregnation and cooking of the chips. The chips are, in connection with the feeding into the chute, exposed to a sudden lowering in the pressure of preferably 0.1-0.5 bar. This lowering in the pressure will lead to that, as is described above, the moist in the cavities of the chip pieces flashes, whereby air is extracted and is replaced with saturated steam. The desired pressure P2 in the chute is sustained with the aid of a condensor 19, which is connected to an outlet conduit 11. One end of the outlet conduit opens out at the upper part of the chute, whereby the mouth always can be above said level of liquid. The conduit 17 is part of a circulation with aid of which the liquid level in the chute is sustained. Liquid is, thereby, pumped from the high pressure feeder, via a sand trap 14 and a tubular screen 15, back to the chute. The liquid pool in the bottom part of the chute holds a temperature T3, which is lower than the temperature T2 of chips and gas phase that is present above the liquid level.

The low pressure feeder can, if so is required, be followed by a feeding screw which the fibre material must pass before it falls down into the chute. The pressure in the screw space is hereby the same as in the chute. The object of the screw, when such is existing, is to give the chips a certain retention time before it falls down into the colder liquid. In this way it is assured that there is time for adequate air extraction.

An alternative to a condensor is that the outlet conduit also comprises an inlet opening for addition of impregnation liquid. It is, in that case, the conduit 17, or a constituent conduit from this conduit, that opens out in the outlet conduit. Steam in the gas phase above the liquid level in the chute will condensate, if the impregnation liquid that is recirculated via the conduit 17 is adequately cold, whereby the pressure of the gas phase

is lowered. The liquid thereafter flows down into the collection of chips/liquid in the lower part of the chute, and thereby takes any chip pieces that might have been jerked into the outlet conduit, with it.

A vertical chip bin 1 is shown in figure 3, to which chip pieces are fed in the top and fed out from the bottom. There is also added steam 20 (fresh steam and/or steam from one of the digester flashes 18) to the chip bin at a level 20a and possibly at a level 20b, which is below the level 20a. The chip pieces are, through the main steam addition at the level 20a, heated in the space 1a, which stretches from the level 20a and upwards, but preferably not all the way up to the chip level, at a pressure P1, which is near atmospheric pressure, to a temperature T1 of about 100°C. The lower part of the chip bin constitutes the second space 1b according to the invention. An outlet conduit 11, which is connected to a condensor 19, is connected to the second space 1b. Thereby is brought about, in the part of the second space 1b which is closest to the connected outlet conduit, a gas atmosphere with a pressure P2, which is marginally lower than P1, and a temperature T2, which is circa 1-2°C lower than T1. The pressure in the remaining part of the second space 1b is also lower than P1, whereby the is a gradient form the entry of the chip pieces into the space 1b, to their feeding out through the feeding device 4. This feeding out device 4 is situated in the bottom of the chip bin.

The space 1b is, in the construction that is shown in figure 3, protruding, in one of its ends, in relation to the remaining part of the chip bin. The outlet conduit 11 is thereby connected to the top of the protruding part and the feeding out device 4 is connected to the bottom of this part. The chip pieces fall, due to this construction, from the chip column that is present in the upper part of the chip bin, diagonally down towards the feeding out device, whereby a space, which is in the main free from chips, arises in the upper part of the protruding part of the

second space 1b. It is, thus, to this space which is free from chips, that the outlet conduit 11 is connected. Several alternative embodiments of this construction are conceivable. One example is that a feeding screw is connected to the bottom of the chip bin and that it, to the upper part of this screw, preferably at the end of it, is connected a second space according to the invention, with a belonging outlet conduit 11. Said first and second spaces according to the invention will thus, as in the embodiments according to figures 1 and 2, thereby, be constituted of separate vessels.

The principle effect on the chip pieces will be the same, even if the lowering of the pressure not is sudden, when the method according to the invention is performed in an apparatus set of the type in figure 3. Air and gases, which through the lowering of the pressure has been brought to be extracted from the chips, to be replaced by steam, is thus withdrawn through the outlet conduit 11. In the following chute there is, in the same way as in figure 2, a gas atmosphere, where the pressure, though, is equal to or higher than in the second space 1b of the chip bin, and a chip- and liquid level, where the liquid holds a lower temperature T3 than the above lying gas atmosphere.

The invention is not limited by the embodiment described above, but can be varied within the scope of the claims. The steaming vessel 2 can, thus, for example, also be atmospheric.

PATENT CLAIMS

1. Method for treatment of comminuted fibre material before chemical digestion of the material, whereby the material,
(a) in a first step is heated, preferably by addition of steam, in a gas atmosphere with a pressure (P1) and a temperature (T1),
(b) in a second step has air extracted from it, in a gas atmosphere with a pressure (P2) and a temperature (T2), where (T1)>(T2) and (P2) is sufficiently lower than (P1) in order to extract air from the material,
(c) in a third step is soaked in impregnation liquid, c h a r a c t e r i s e d i n that said first step (a) is performed in a first space (1, 2, 1a) and said second step (b) is performed in a second space (3, 1b), whereby the material is added to this second space in such a way that it is exposed to a lowering in the pressure, when it is transferred from the first space to the second space and that said impregnation liquid with a temperature (T3) is added to said material in sequentially direct connection to a retention time in the gas atmosphere (P2, T2) in said second space.

2. Method according to claim 1, c h a r a c t e r i s e d i n that said first and second spaces are constituted of separate vessels.

3. Method according to any one of the above claims, c h a r a c t e r i s e d i n that said material, while being transferred, by a sluice device (10), from the first space (1, 2) to the second (3), is exposed to a sudden lowering of the pressure.

4. Method according to any one of the preceding claims, c h a r a c t e r i s e d i n that said lowering of the pressure is within the range 0.01-1.0 bar, preferably 0.02-0.7 bar and even more preferably 0.1-0.5 bar.

5. Method according to any one of the above claims, c h a r a c t e r i s e d i n that the extraction of air in the second step (b) is taking place at an underpressure, preferably at a pressure 1 bar (abs)>P2>0.3 bar (abs).

6. Method according to any one of the above claims, c h a r a c t e r i s e d i n that the soaking in impregnation liquid (c) takes place in the same space (3) as the extraction of air (b).

7. Method according to any one of the above claims, c h a r a c t e r i s e d i n that the impregnation liquid in the third step (c) holds a temperature (T3) which is lower than the temperature of the material and the gas phase in the second step (b), and a temperature which is lower than the temperature (T1) of the material and gas phase in the first step, whereby 100°C>T1-T3>10°C, preferably 60°C>T1-T3>20°C.

8. Method according to claim 1, c h a r a c t e r i s e d i n that the heating in said first step (a) is taking place during a time interval of below 5 minutes, preferably below 4 minutes and even more preferably below 3 minutes.

9. Apparatus for treatment of comminuted fibre material before chemical digestion of the material, comprising a vessel (1, 2) with devices for addition of steam, which vessel is operatively connected to a sluice device (10) for feeding the material to a chute (3) with devices for sustaining levels of chips and liquid therein, c h a r a c t e r i s e d i n that said sluice device (10) passes the fibre material through a lock, from a higher pressure to a lower pressure.

10. Apparatus according to claim 9, c h a r a c t e r i s e d i n that said chute comprises

an outlet conduit (11), one end of which opens out at the upper part of said chute (3), so that the mouth always can be above said level of liquid.

11. Apparatus according to claim 10, c h a r a c t e r i s e d i n that said outlet conduit (11) comprises an inlet opening for addition (17) of impregnation liquid.

AMENDED CLAIMS
[received by the International Bureau on 02 February 1998 (02.02.98); original claims 1-11 replaced by amended claims 1-16 (4 pages)]

1. Method for treatment of comminuted fibre material before chemical digestion of the material, whereby the material,
(a) in a first step is heated, by direct addition of steam, in a gas atmosphere with a pressure (P1) and a temperature (T1),
(b) in a second step has air extracted from it, in a gas atmosphere with a pressure (P2) and a temperature (T2), where (T1)>(T2) and (P2) is sufficiently lower than (P1) in order to extract air from the material,
(c) in a third step is soaked in impregnation liquid,
c h a r a c t e r i s e d i n that said first step (a) is performed in a first space (1, 2, 1a) and said second step (b) is performed in a second space (3, 1b), whereby the material is added to this second space in such a way that it is exposed to a lowering in the pressure, when it is transferred from the first space to the second space and that said impregnation liquid with a temperature (T3) is added to said material in sequentially direct connection to a retention time in the gas atmosphere (P2, T2) in said second space.

2. Method according to claim 1,
c h a r a c t e r i s e d i n that said first and second spaces are constituted of separate vessels.

3. Method according to any one of the above claims,
c h a r a c t e r i s e d i n that said material, while being transferred, by a sluice device (10), from the first space (1, 2) to the second (3), is exposed to a sudden lowering of the pressure.

4. Method according to any one of the preceding claims, c h a r a c t e r i s e d i n that said lowering of the pressure is within the range 0.01-1.0 bar, preferably 0.02-0.7 bar and even more preferably 0.1-0.5 bar.

5. Method according to any one of the above claims, c h a r a c t e r i s e d i n that the extraction of air in the second step (b) is taking place at an underpressure, preferably at a pressure 1 bar (abs)>P2>0.3 bar (abs).

6. Method according to any one of the above claims, c h a r a c t e r i s e d i n that the soaking in impregnation liquid (c) takes place in the same space (3) as the extraction of air (b).

7. Method according to any one of the above claims, c h a r a c t e r i s e d i n that the impregnation liquid in the third step (c) holds a temperature (T3) which is lower than the temperature of the material and the gas phase in the second step (b), and a temperature which is lower than the temperature (T1) of the material and gas phase in the first step, whereby 100°C>T1-T3>10°C, preferably 60°C>T1-T3>20°C.

8. Method according to claim 1, c h a r a c t e r i s e d i n that the heating in said first step (a) is taking place during a time interval of below 5 minutes, preferably below 4 minutes and even more preferably below 3 minutes

9. Method according to claim 1, c h a r a c t e r i s e d i n that said first (1a) and second spaces (1b) are accommodated in the same vessel (1).

10. Method according to claim 9, c h a r a c t e r i s e d i n that said second step (b) is performed at a temperature (T2), which is circa 1-2°C lower than (T1) and in that the said lowering in pressure, in connection with the transferring of the material from the first space (1a) to the second space (1b), is marginal.

11. Method according to claim 9 or 10, c h a r a c t e r i s e d in that said soaking in impregnation liquid (c) takes place in another space than the extraction of air (b).

12. Method according to any of the claims 9-11, c h a r a c t e r i s e d i n that the second space (1b) is protruding, in at least one of its ends, in relation to the remaining part of the vessel (1).

13. Method according to claim 12, c h a r a c t e r i s e d i n that there is a space, which is in the main free from fibre material, in the upper part of the protruding part of the second space (1b) and that there is connected an outlet conduit (11) to this upper part of the protruding part.

14. Apparatus for treatment of comminuted fibre material before chemical digestion of the material, comprising a vessel (1, 2) with devices for addition of steam, which vessel is operatively connected to a sluice device (10) for feeding the material to a chute (3) with devices for sustaining levels of chips and liquid therein, c h a r a c t e r i s e d i n that said sluice device (10) passes the fibre material through a lock, from a higher pressure to a lower pressure.

15. Apparatus according to claim 14,

c h a r a c t e r i s e d i n that said chute comprises an outlet conduit (11), one end of which opens out at the upper part of said chute (3), so that the mouth always can be above said level of liquid.

16. Apparatus according to claim 15, c h a r a c t e r i s e d i n that said outlet conduit (11) comprises an inlet opening for addition (17) of impregnation liquid.

Figure 1

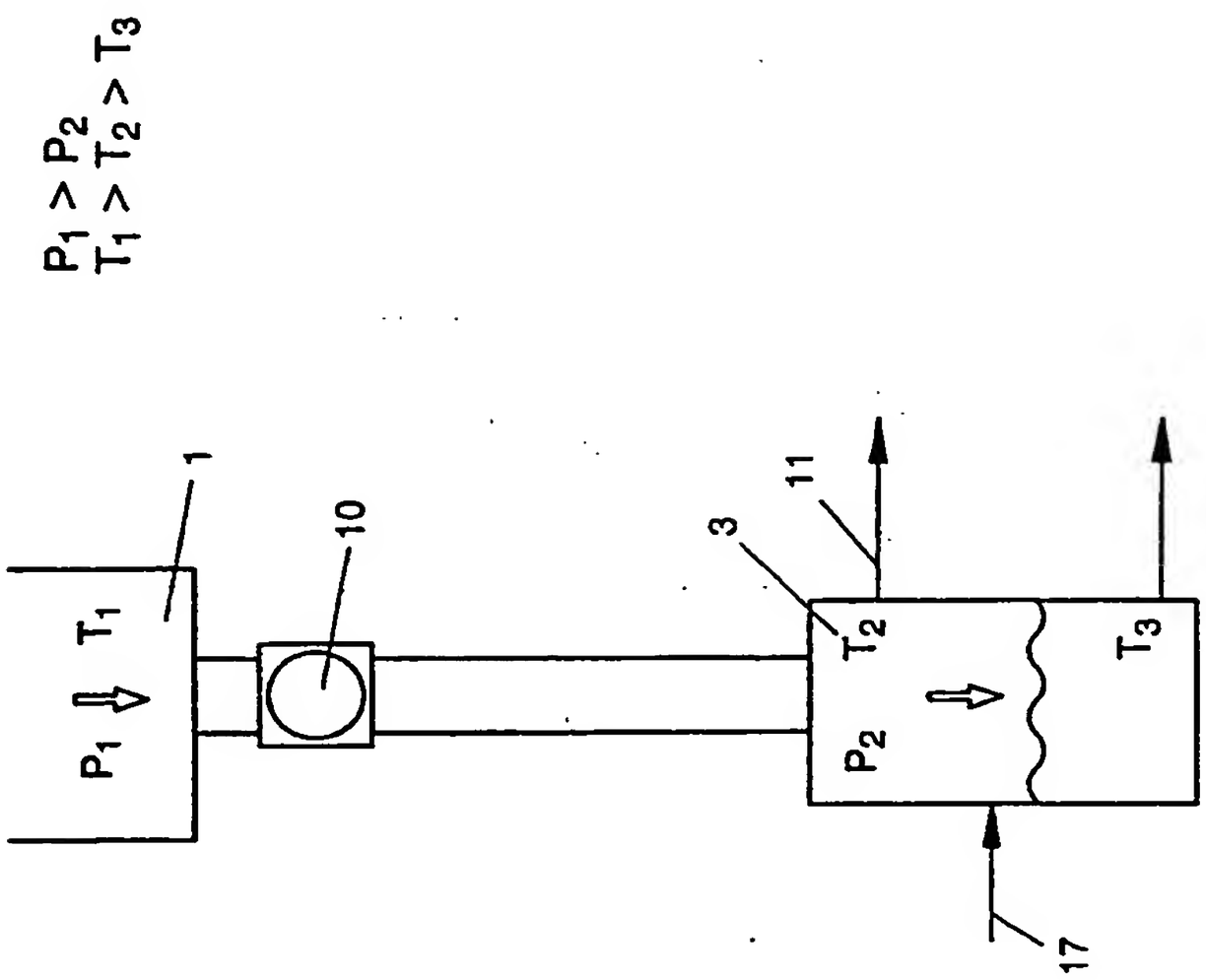


Figure 2

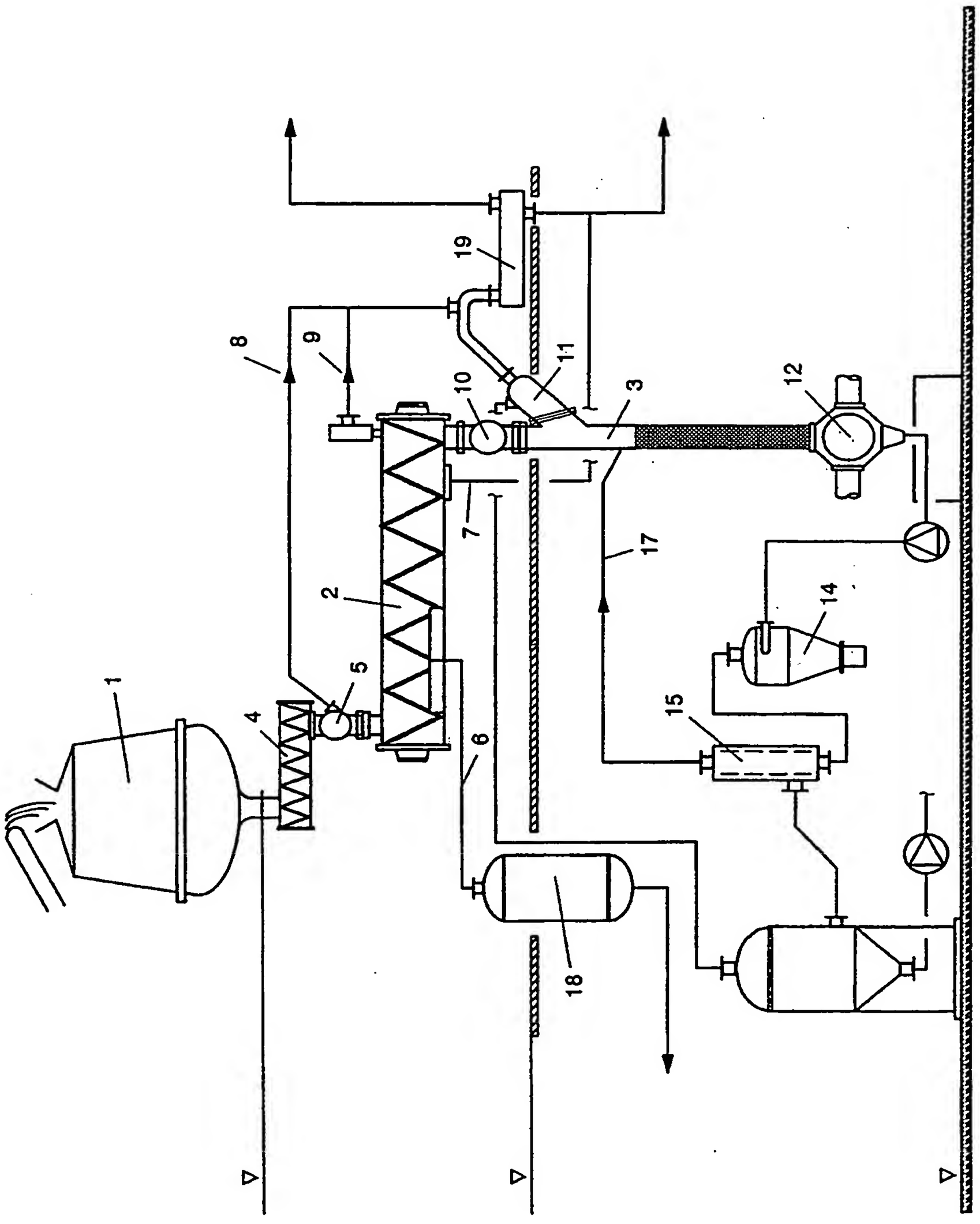
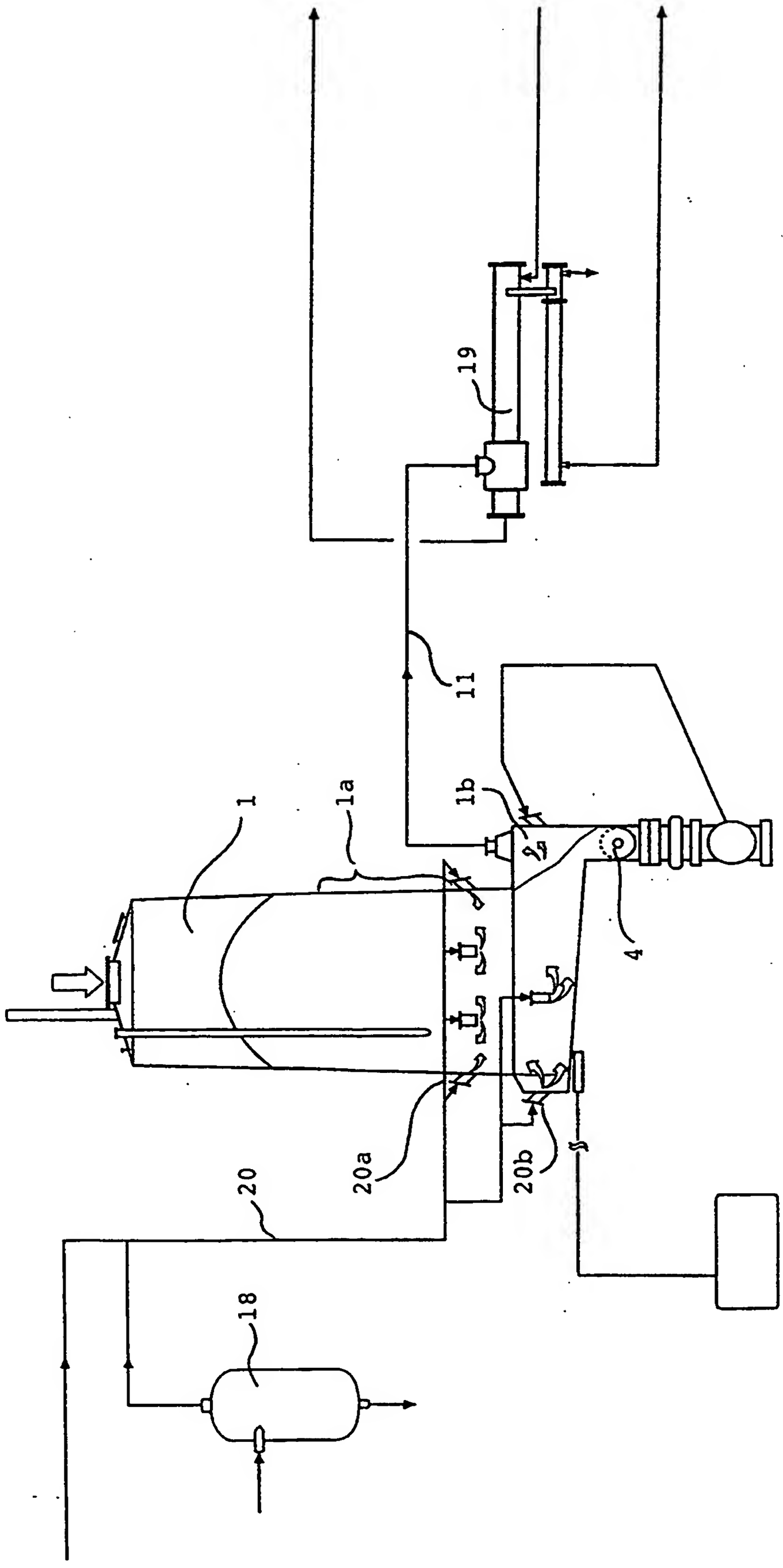


Figure 3



INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 97/00193

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: D21C 1/02, D21C 1/10
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: D21C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3215587 A (S.A. GUERRIERI), 2 November 1965 (02.11.65), column 1, line 66 - column 3, line 23	1-6,8-11
Y	--	7
Y	US 3294625 A (A.W. GESSNER), 27 December 1966 (27.12.66), column 2, line 22 - column 3, line 10	7
X	--	9-11
X	SE 152117 C (AVESTA JERNVERKS AB), 25 October 1955 (25.10.55), page 1, column 2, line 15 - page 2, column 1, line 36	1-5
	--	

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 Sept 1997	29 -09- 1997
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Marianne Bratsberg Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 97/00193

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	SE 169725 C (THE BAUER BROS. CO.), 8 December 1959 (08.12.59), page 2, column 1, line 25 - column 2, line 2	1-11
A	WO 9509267 A1 (AHO, ANTTI), 6 April 1995 (06.04.95), claim 1	1-11
A	US 3278367 A (F.A. LOEBEL), 11 October 1966 (11.10.66), claim 1	1-11

INTERNATIONAL SEARCH REPORT
Information on patent family members

01/09/97

International application No.
PCT/SE 97/00193

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3215587 A	02/11/65	NONE	
US 3294625 A	27/12/66	NONE	
SE 152117 C	25/10/55	NONE	
SE 169725 C	08/12/59	NONE	
WO 9509267 A1	06/04/95	AU 7700094 A	18/04/95
US 3278367 A	11/10/66	DE 1255472 B	00/00/00